

## A coherent dual vector field theory for gravitation

Analytical method – Applications on cosmic phenomena

T. De Mees

### Abstract

This publication concerns the fundamentals of the dynamics of masses interacting by gravitation.

We start with the Maxwell Analogy for Gravitation (or the “Heaviside field”), and we develop a model. This model of dynamics, allow us to quantify the transfer of angular movement point by point by the means of vectors, and to bring a simple, precise and detailed explanation to a large number of cosmic phenomena. And to all appearances, the theory completes gravitation into a wave theory.

With this model the flatness of our solar system and our Milky way can be explained as being caused by an angular collapse of the original orbits, creating so a density increase of the disc. Also the halo is explained. The “missing mass” (dark matter) problem is solved, and without harming the Keplerian motion law.

The theory also explains the deviation of mass like in the double-lobed shape of rotary supernova having mass losses, and it defines the angle of mass losses at  $0^\circ$  and under  $35^\circ 16'$ .

Some quantitative calculations describe in detail the relativistic attraction forces maintaining entire the fast rotating stars, the tendency of distortion toward a toroid-like shape, and the description of the attraction fields outside of a rotary black hole. Qualitative considerations on the binary pulsars show the process of cannibalization, with the repulsion of the mass at the poles and to the equator, and this could also explain the origin of the *spin-up* and the *spin-down* process. The bursts of collapsing rotary stars are explained as well. The conditions for the repulsion of masses are also explained, caused by important velocity differences between masses. Orbit chaos is better explained as well. Finally, the demonstration is made that gyrotation is related to the Relativity Theory.

**Keywords.** gravitation – star: rotary – disc galaxy – repulsion – relativity – gyrotation – chaos – methods : analytical

**Photographs :** ESA / NASA

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## 1. Introduction : the Maxwell analogy for gravitation: a short history.

Several studies have been made earlier to find an analogy between the Maxwell formulas for electromagnetism and the gravitation theory. Newton's equation for gravitation is analogue to the force equation of electric charges. But does magnetism has a counterpart in gravitation?

Yes it has. O. Heaviside, in 1893, suggested the field. This implies the existence of a second field, as a result of the transversal time delay of gravitation waves. Further theoretical development was also made by several authors. L. Nielsen, 1972, deducted it independently using the Lorentz invariance. E. Negut, 1990 extended the Maxwell equations more generally and discovered the consequence of the flatness of the planetary orbits, O. Jefimenko, 1992, rediscovered it, deducted the field from the time delay of light, and developed important thoughts about it in several books, and M. Tajmar & C.de Matos, 2003, worked on the same subject.

The deduction of the second gravitation field follows from the gravitation law of Newton, by considering the transversal forces resulting from the relative velocity of masses, analogously to electromagnetism. The laws can be expressed in the equations (1) to (5) hereunder.

### *Lecture A : a word on the Maxwell analogy*

The formulas (1.1) to (1.5) form a coherent set of equations, similar to the Maxwell equations. Electrical charge is then substituted by mass, magnetic field by gyrotation, and the respective constants as well are substituted (the gravitation acceleration is written as  $\mathbf{g}$ , the so-called "gyrotation field" as  $\mathbf{\Omega}$ , and the universal gravitation constant as  $G = (4\pi \zeta)^{-1}$ ). We use sign  $\Leftarrow$  instead of  $=$  because the right hand of the equation induces the left hand. This sign  $\Leftarrow$  will be used when we want to insist on the induction property in the equation.  $\mathbf{F}$  is the induced force,  $\mathbf{v}$  the velocity of mass  $m$  with density  $\rho$ . Operator  $\times$  is used as a cross product of vectors.

$$\mathbf{F} \Leftarrow m (\mathbf{g} + \mathbf{v} \times \mathbf{\Omega}) \quad (1.1)$$

$$\nabla \cdot \mathbf{g} \Leftarrow \rho / \zeta \quad (1.2)$$

$$c^2 \nabla \times \mathbf{\Omega} \Leftarrow \mathbf{j} / \zeta + \partial \mathbf{g} / \partial t \quad (1.3)$$

where  $\mathbf{j}$  is the flow of mass through a surface. The term  $\partial \mathbf{g} / \partial t$  is added for the same reasons as Maxwell did: the compliance of the formula (1.3) with the equation

$$\text{div } \mathbf{j} \Leftarrow - \partial \rho / \partial t$$

It is also expected

$$\text{div } \mathbf{\Omega} \equiv \nabla \cdot \mathbf{\Omega} = 0 \quad (1.4)$$

and

$$\nabla \times \mathbf{g} \Leftarrow - \partial \mathbf{\Omega} / \partial t \quad (1.5)$$

All applications of the electromagnetism can from then on be applied on the *gyrogravitation* with caution. Also it is possible to speak of gyrogravitation waves.

## 2. Law of gravitational motion transfer.

The exact interpretation of this second field  $\mathbf{\Omega}$  in (1.3) needs to be explained. In the Maxwell Analogy theory the existence of the field  $\mathbf{\Omega}$  means that the angular motion (we use "motion" and not "momentum" because we will talk about velocities at the first place) is transmitted by gravitation. In fact no object in space moves straight, and each motion can be seen as an angular motion.

Considering a rotary central mass  $m_1$  spinning at a rotation velocity  $\omega$  and a mass  $m_2$  in orbit, the *rotation transmitted by gravitation through space* (dimension [rad/s]) is named *gyrotation*  $\mathbf{\Omega}$ .

Equation (1.3) (without the term  $\partial \mathbf{g} / \partial t$ ) can also be written in the integral form as in (2.1), and interpreted as a flux theory (see Lecture B). It expresses that the normal component of  $\text{rot } \mathbf{\Omega}$ , integrated on a surface  $A$ , is directly proportional with the flow of mass through this surface.

For a section A of a spinning sphere, going through the spin axis,  $\nabla \times \Omega$  expresses the distribution of  $\Omega$  on the surface A. Hence, one can write:

$$\iint_A (\nabla \times \Omega)_n dA \Leftarrow 4\pi G \dot{m} / c^2 \quad (2.1)$$

*Lecture B : a word on the flux theory approach*

where a dot above a variable means its time derivative.

In order to interpret this equation in a convenient way, the theorem of Stokes is used and applied to the gyrotation  $\Omega$ . This theorem says that the loop integral of a vector equals the normal component of the differential operator of this vector.

*Lecture C : a word on the application of the Stokes theorem and on loop integrals*

$$\oint \Omega dl = \iint_A (\nabla \times \Omega)_n dA \quad (2.2)$$

Hence, the transfer law of gravitation rotation (*gyrotation*) results in:

$$\oint \Omega dl \Leftarrow 4\pi G \dot{m} / c^2 \quad (2.3)$$

This means that mass in motion through a gravitation field, causes a second field, called gyrotation.

### 3. Gyrotation of a moving mass in an external gravitational field.

Let us apply (2.3) in an example. It is known from the analogy with magnetism that a moving mass in a gravitation reference frame will cause a circular gyrotation field (fig. 3.1). Another mass which moves in this gyrotation field will be deviated by a force, and this force works also the other way around, as shown in fig. 3.2.

The gyrotation field, caused by the motion of  $\dot{m}$  is given by (3.1) using (2.3). The equipotentials are circles:

$$2\pi R \Omega_p \Leftarrow 4\pi G \dot{m} / c^2 \quad (3.1)$$

Later in this paper, we will see how important it is to define what I name “Local Absolute Velocity”. Traditionally, (since the Heaviside epoch), velocity is considered in relation to an observer. In our Maxwell Analogy, we define that velocity must be seen in relation to the “local main gravitation field”. In practice, this means “the largest object of the studied gravitational system”, such as the sun in our solar system, or the bulge in our Milky Way. In fact, if I say “main gravitation field”, I simplify strongly. Because every mass in the universe is generating a gravitation field, and is also creating a gyrotation field about a moving mass. But mostly, these secondary gravitation fields are totally negligible.

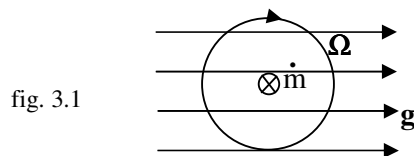


fig. 3.1

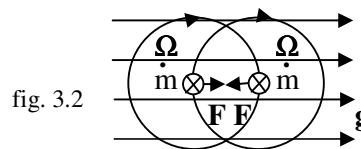


fig. 3.2

In this example, it is very clear how (absolute local) velocity has to be defined. It is compared with the steady gravitation field where the mass flow lays in.

This application can also be extrapolated in the example below: the gyrotation of a rotating sphere.

### 4. Gyrotation of rotating bodies in a gravitational field.

Consider a rotating body like a sphere. We will calculate the gyrotation at a certain distance from it, and inside it. We consider the sphere being enveloped by a gravitation field, generated by the sphere itself, and at this condition, we can apply the analogy with the electric current in closed loop.

The approach for this calculation is similar to the one of the magnetic field generated by a magnetic dipole.

We take an infinitesimal magnetic dipole, which we obtain by an infinitesimal rotating mass flow in closed loop, and we integrate this to the whole sphere. (Reference: Richard Feynmann: Lectures on Physics)

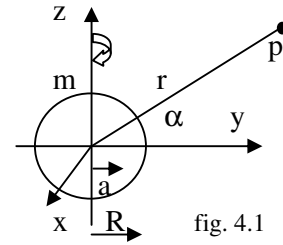
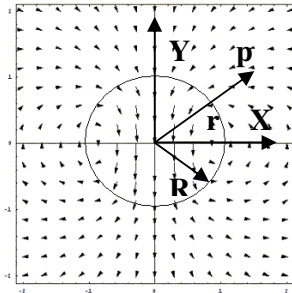


fig. 4.1

The results are given by equations inside the sphere (4.1) and outside the sphere (4.2):



$$\Omega_{\text{int}} \leftarrow \frac{4 \pi G \rho}{c^2} \left( \omega \left( \frac{2}{5} r^2 - \frac{1}{3} R^2 \right) - \frac{\mathbf{r} (\mathbf{r} \cdot \omega)}{5} \right) \quad (4.1)$$

$$\Omega_{\text{ext}} \leftarrow \frac{4 \pi G \rho R^5}{5 r^3 c^2} \left( \frac{\omega}{3} - \frac{\mathbf{r} (\omega \cdot \mathbf{r})}{r^2} \right) \quad (4.2)$$

fig. 4.2

(Reference: adapted from Eugen Negut, www.freephysics.org) The drawing shows equipotentials of  $-\Omega$ .

wherein  $\bullet$  means the scalar product of vectors. For homogeny rigid masses we can write :

$$\Omega_{\text{ext}} \leftarrow \frac{G m R^2}{5 r^3 c^2} \left( \omega - \frac{3 \mathbf{r} (\omega \cdot \mathbf{r})}{r^2} \right) \quad (4.3)$$

When we use this way of thinking, we should keep in mind that the sphere is supposed to be immersed in a steady reference gravitation field, namely the gravitation field of the sphere itself .

### 5. Angular collapse into prograde orbits. Precession of orbital spinning objects.

Let us analyze masses orbiting about a large central mass. If that central mass (take the sun) has a spin, one finds two major effects due to gyrotation.

#### The angular collapse of orbits into prograde equatorial orbits.

In analogy with magnetism, we can expect that the field lines of the gyrotation  $\Omega$ , for the space outside of the mass itself, have equipotential lines as shown in fig. 5.1. For every point of the space, a local gyrotation can be found from (4.2).

So  $v_p = r \omega_p$  is the orbit velocity of the mass  $m_p$ , it gets an acceleration:  $a_p \leftarrow v_p \times \Omega_p$  -deducted from (1.1)-

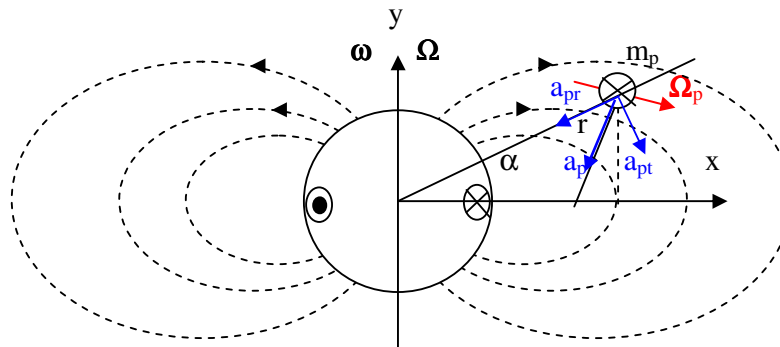


fig. 5.1

where  $a_p$  is pointed in a direction, perpendicular on the equipotentials line. One finds the tangential component  $a_{pt}$  and the radial component  $a_{pr}$  by using (4.2).

The acceleration  $a_{pt}$  always sends the orbit of  $m_p$  towards the equator plane of  $m$ . And so  $m_p$  has a retrograde orbit (negative  $\Omega_p$ ),  $a_{pt}$  will change sign in order to make twist the orbit, away from the equator. Finally, this orbit will twirl such that the sign of  $\Omega_p$  and therefore the sign of  $a_{pt}$  become again positive ( $\alpha > \pi/2$ ), (prograde orbit), and the orbit will perform a precession with decreased oscillation around the equator.

The component  $a_{pr}$  is responsible for a slight orbit diameter decrease or increase, depending on the sign of  $\Omega_p$ . Ignoring this effect leads to a slight misjudgement of the real mass of the planets of the planetary system.

We call this effect the *angular collapse of orbits*. The strength of this effect is of order  $1/c^2$  smaller than that of gravitation itself, provided that the velocities involved are significant.

### The precession of orbital spinning objects.

A second effect occur if the small mass is also spinning.

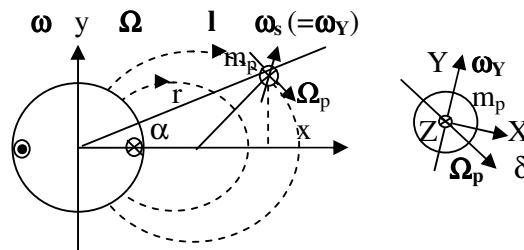


Fig. 5.2

Detail

If the mass  $m_p$  is also spinning, with a speed  $\omega_s$ , one gets: the momentum  $M_Z$  of  $m_p$  created by  $\Omega_p$  results from the forces acting on the rotating particle -from (1.1)-:

$$\mathbf{a}_\Omega \Leftarrow \mathbf{v}_Z \times \Omega_p \quad \text{where we write the average velocity } \mathbf{v}_Z \text{ as} \quad \mathbf{v}_Z = \omega_Y \times \mathbf{X} \quad \text{for } m_p$$

with  $\mathbf{X}$  the equivalent momentum radius for the whole sphere.

Therefore also for  $m_p$ :  $M_Z \Leftarrow 2 \omega_Y X^2 \Omega_p \cos \delta$ .

This means: except in the case of an opposite spin orientation of  $\omega_Y$  and  $\omega$ , the gyrotation of  $m_1$  will always influence the rotation  $\omega_Y$ , by generating a precession on  $m_p$ .

This precession is extremely small for planets of our solar system, with an extremely long cycle period, and is probably impossible to measure. However, in systems with fast rotating stars, the effect is very important.

*Lecture D : a word on planetary systems*

## 6. Structure and formation of prograde Disc Galaxies.

For spherical galaxies with a spinning centre, two different evolutions can be found, depending from the fact whether the stars are orbiting or not. One evolution for objects with an initial tangential velocity (in orbit), and another for objects without orbit (zero initial velocity).

### Objects with an orbit

Objects with an orbit will undergo an angular collapse into prograde orbits due to the first effect of section 5. Ejection out of the galaxy is also possible during this collapse motion for retrograde orbits, because  $a_{pr}$  is pointing away from the mass  $m$  (opposite forces as in fig.5.1 in that case).

The angular collapse starts from the first spherical zone near the central zone, where the gyrotation is strong and the collapse quick. Every star orbit will undergo an absorbed oscillation in the equator region of mass  $m$ , due to the angle-dependent acceleration  $a_{pt}$ . This oscillation brings stars closer together. It becomes quickly a group of stars, or even a part of the future disc, and the stars turn out to be more and more in phase. It can become a distorted disc with a sinuous aspect, and finally a disc.



The final tangential velocity  $v_{\theta, disc}$  depends from the start position  $\alpha_0$ ,  $r_0$  and the initial tangential velocity  $v_{\theta 0}$ . At the same final radius, several stars with diverse velocities may join.

Distant stars outside the disc will oscillate “indefinitely”, or will be partly captured by the disc’s gravitation. Remark: perfectly plane retrograde orbits, which existed “since the beginning” at the equator level of the galaxy before the start of the orbit collapse process, can theoretically subsist until a very close encounter or a collision with any prograde object deflects it.

### Objects without an orbit

When a numerical simulation is made of the evolution of objects without an orbital motion, and which are just falling towards the galaxy’s centre, the result is a wide oscillation about the galaxy’s centre.

It is expected that some stars closer to the disc -while oscillating- can be partially captured by its gravitation forces. What is the theoretical background for this behaviour?

In the following few lines, one discovers the complexity of the motion. It appears that the analytical description of the evolution is not successful any more. Only a numerical approach gives clarity.

The law for gravitational attraction is 
$$g_r \leftarrow -G m / r^2 \tag{6.1}$$

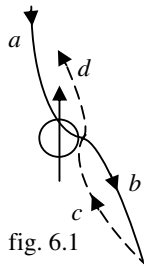


fig. 6.1

This radial displacement creates a gyrotation acceleration due to (1.1), deviating the object in a retrograde way

$$a_{\theta} \leftarrow v_r \times \Omega \tag{6.2}$$

in the z-direction, where  $\Omega$  is given by (4.2). See fig. 6.1.a and c.

When the object does not crashes on the rotating centre but misses it, it comes in a region where now a prograde deviation is created (fig. 6.1.b). The object will oscillate around the star as follows: when falling towards the star, a retrograde deviation is created (fig. 6.1.a and c), when quitting the star, a prograde deviation is created (fig. 6.1.b and d).

### Stellar clusters’ trajectories

We could wonder if stellar clusters are obeying this law instead of their presumed converging orbits towards the centre of the galaxy. Since those stars are considered as the oldest ones of the galaxy, it is unlikely that converging would occur. Instead, they will more likely oscillate as objects without an orbit, as explained higher (fig. 6.1) in such a way that these forces avoid convergence to the galaxy’s centre.

### Lecture E : a word on the formation of disc galaxies

### Calculation of the constant velocity of the stars around the bulge of plane galaxies

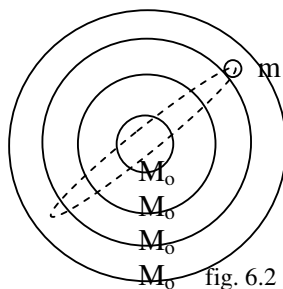


fig. 6.2

Generally, it is claimed that a huge amount of invisible, black matter would be present in space, in order to explain the constant velocity of all stars in a disc galaxy. Indeed, it is strange that the stars’ velocity is not related to the distance to the centre, as the Kepler law stipulates.

We shall see here that the constant velocity of the stars can be explained very simply, by using the Maxwell Analogy.

Let’s take again the spherical galaxy with a rotary centre (fig. 6.2). The distribution of the mass is such, that a star only feels the gravitation of the centre. We consider

equal masses  $M_o$  (mass of the centre, named “the bulge”) in various concentric hollow spheres according to some function of  $R$  (it must not be linear). We take the total bulge as the centre mass because that part does not collapse into a disk, and so, it has to be considered as part of the rotary centre of the galaxy. Possibly, the orbit can be disturbed by the passage of other stars, but in general one can say that only the centre  $M_o$  has an influence according to:

$$F_R = G \frac{M_o m}{R^2} \quad \text{and} \quad F_C = \frac{m v^2}{R} \quad (6.3) \quad (6.4)$$

$$\text{So} \quad F_R = F_C \Rightarrow v^2 = \frac{G M_o}{R} \quad (6.5)$$

When the angular collapse of the stars is done, creating a disc around the bulge, the following effect occurs: the mass which before took in the spherical volume  $(4/3) \pi R^3$ , will now be compressed in a volume  $\pi R^2 h$  where  $h$  is the height of the disc, that is a fraction of the diameter of the initial sphere (fig. 6.3). In the figure, we have defined zones 0, 1, 2 etc...

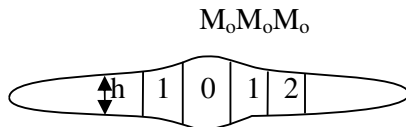


fig. 6.3

And at the distance  $R$ , a star feels more gravitation than the one generated by the mass  $M_o$ .

To a distance  $k R_o$ , the star will be submitted to the influence of about  $n M_o$ , where  $k$  and  $n$  are supposed to be linear functions passing through zero in the centre of the bulge.

Strong simplified, this gives for the total mass according to the distance  $R$ :

$$v_{r2}^2 = \frac{G n M_o}{k R_o} \quad (6.6)$$

Therefore, one can conclude that :

$v_{r2} = \text{constant}$

Concerning the centre, zone zero, one cannot say much. Let's not forget that a part of the angular momentum has been transmitted to the disc, and that the centre is not a point but a zone.

For zone one, we can say that the function of the gyrogravitation forces must be somewhere between the one of the initial sphere and the zone 2.

**Example : calculation of the stars' velocity of the Milky Way**

These findings are completely compatible with the measured values.

The diagram shows a typical example, which shows the velocities of stars for our Milky Way.

Using equation (6.6) for our Milky Way, with the reasonable estimate of a bulge diameter of 10000 light years having a mass of 20 billion of solar masses (10% of the total galaxy), and admitting that  $k = n$  we get a quite correct orbital velocity of 240 km/s (fig. 6.4).

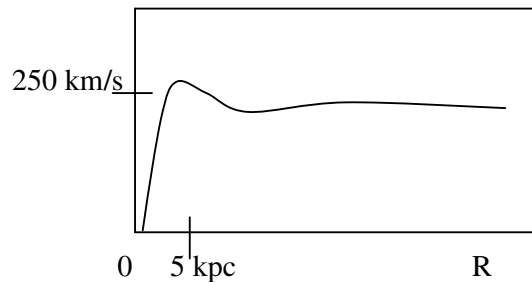


fig. 6.4

**Dark matter and missing mass are not viable**

The problem of the 'missing mass' or 'dark matter' that have never been found and that had to bring an explanation for the stars' velocity constancy is better solved with our theory: the velocity constancy is entirely due to the formation of the plane galaxy without a need of invisible masses.

## 7. Unlimited maximum spin velocity of compact stars.

When a supernova explodes, this happens only partially and in specific zones, forming so a magnificent symmetric shape.

The purpose here is to find out why this happens so.

Let us consider the fast rotary star, on which the forces on  $p$  are calculated (fig. 7.1). We don't want to polemic on the correct shape for the supernova, and suppose that it is still a homogeny sphere. If the mass distribution is different, we will approximate it by a sphere.

For each point  $p$ , the gyrotation can be found by putting  $r = R$  in (4.2). And taken in account the velocity of  $p$  in this field, the point  $p$  will undergo a gyrotation force which is pointing towards the centre of the sphere.

Replacing also the mass by  $m = \pi R^3 \rho \frac{4}{3}$  we get (4.2) transformed as follows:

$$\Omega_R \Leftarrow \frac{G m}{5 R c^2} \left[ \omega - \frac{3 R (\omega \cdot R)}{R^2} \right] \quad (7.1)$$

The gyrotation accelerations are given by the following equations:

$$a_x \Leftarrow x \omega \Omega_y = \omega R \cos\alpha \Omega_y \quad \text{and} \quad a_y \Leftarrow x \omega \Omega_x = \omega R \cos\alpha \Omega_x$$

To calculate the gravitation at point  $p$ , the sphere can be seen as a point mass. Taking in account the centrifugal force, the gyrotation and the gravitation, one can find the total acceleration :

$$a_{x \text{ tot}} \Leftarrow R \omega^2 \cos\alpha \left( 1 - \frac{G m (1 - 3 \sin^2\alpha)}{5 R c^2} \right) - \frac{G m \cos\alpha}{R^2} \quad (7.2)$$

$$- a_{y \text{ tot}} \Leftarrow 0 + \frac{3 G m \omega^2 \cos^2\alpha \sin\alpha}{c^2} + \frac{G m \sin\alpha}{R^2} \quad (7.3)$$

The gyrotation term is therefore a supplementary compression force that will stop the star from exploding. For elevated values of  $\omega^2$ , the last term of (7.2) is negligible, and will maintain below a critical value of  $R$  a global compression, regardless of  $\omega$ . This limit is given by the Critical Compression Radius:

$$0 = 1 - \frac{G m (1 - 3 \sin^2\alpha)}{5 R c^2}$$

or

$$\boxed{R = R_{C\alpha} < R_C (1 - 3 \sin^2\alpha)} \quad (7.4)$$

where  $R_C$  is the Equatorial Critical Compression Radius for Rotary Spheres :

$$\boxed{R_C = G m / 5 c^2} \quad (7.5)$$

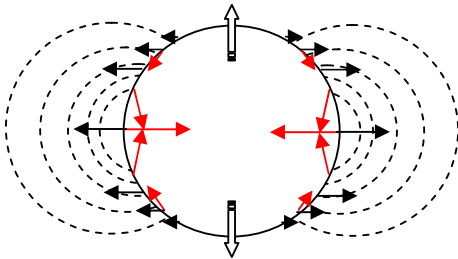


Fig. 7.2

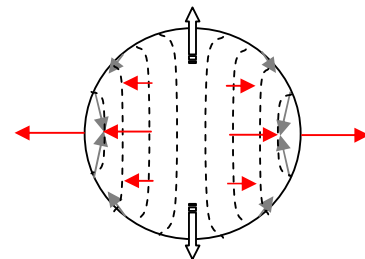


Fig. 7.3

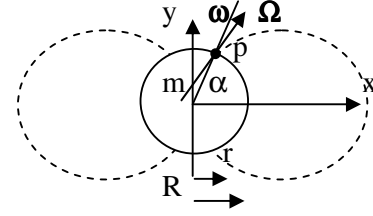


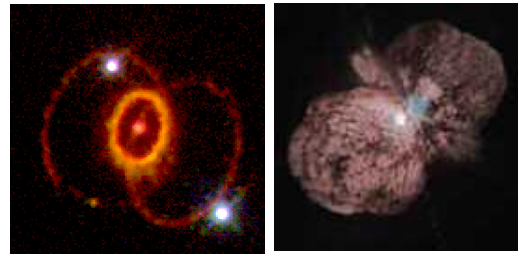
fig. 7.1

$R_C$  is  $1/10^{\text{th}}$  of the Schwarzschild radius  $R_S$  valid for non-rotary black holes ! This means that classic black holes can explode when they are fast spinning, and that every non-exploding fast spinning star must be a black hole. The fig. 7.2 shows the gyrotation and the centrifugal forces at the surface of a spherical star. The same deduction can be made for the equipotentials of gyrotation inside the star. Fig. 7.3 shows the gyrotation lines and forces at the inner side of the star. We see immediately that (7.4) has to be corrected : at the equator, the gyrotation forces of the inner and the outer material are opposite. So, (7.4) is valid for  $\alpha \neq 0$ .

From (7.4) also results that the shape of fast rotating stars stretches toward an *Dyson* ellipse and even a toroid: if  $\alpha \geq 35^\circ 16'$  the Critical Compression Radius becomes indeed zero. Contraction will indeed increase the spin and change the shape to a “tire” or toroid black hole, like some numeric calculations seem to indicate. (Ansorg et al., 2003, A&A, Astro-Ph.).

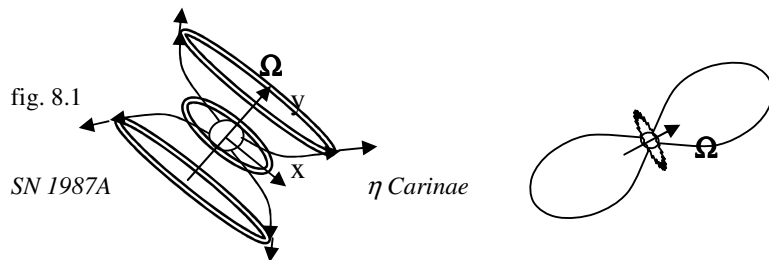
## 8. Origin of the shape of mass losses in supernovae.

When a rotary supernova ejects mass, the forces can be described as in section 6 for objects without an orbit, but with an high initial velocity from the surface of the star. Due to (1.1) , at the equator the ejected mass is deviated in a prograde ring, which expansion slows down by gravitation and will in the end collapse angularly when contraction starts again, but by maintaining the prograde rings as orbits.



When the mass leave under angle, a prograde ring is obtained, parallel to the equator, but outside of the equator’s plane. This ring expands in a spiral, away from the star, because of its initial velocity. The expansion slows down, and will get an angular collapse by the gyrotation working on the prograde motion.

The probable origin of the angle has been given in section 7, equation (7.6) : the zones of the sphere near the poles are the “weakest”. Indeed, these zones have a gyrotation pointing perpendicularly on the surface of the sphere, so that the gyrotation acceleration points tangentially at this surface, making any compensation with the centripetal force impossible. The zone near the equator ( $0^\circ$ ) has no gyrotation force which could hold the mass together in compensation of the centripetal force.



The observation complies perfectly with this theoretical deduction. The supernovae explode into symmetric lobes, with a central disc. Observation will have to verify that these lobes start nearby our defined angle  $35^\circ 16'$ , measured from the equator.

*SN 1987A: a local mass loss took place on the equator and at  $\alpha_c$ , probably close to the  $35^\circ 16'$  angle. The zone near the poles exploded possibly much earlier, so it became a toroid-like shaped rotary star.*  
 *$\eta$  Carinae : mass loss by complete shells, above  $\alpha_c$ , near the  $35^\circ 16'$  angle, forming two lobes with a central ring.*

## 9. Dynamo motion of the sun.

It is observed that the spots on the sun have a displacement from nearby the poles to the equator. This takes about 11 years, and it provides evidence for a double internal tore rotation: one in the northern hemisphere and one in the southern. Plasma enter inwards the sun at the equator and leave near the poles. This effect can be explained by the gyrotation forces.

Equation (7.1) gives the gyrotation field at the level of the sun. Equations (7.2) and (7.3) can be expressed as a new set of components to the surface of the sun: a tangential component and a radial one.

$$a_{t \text{ tot}} \Leftarrow \omega^2 \sin 2\alpha \left( \frac{R}{2} + \frac{G m}{5 c^2} \right) \quad (9.1)$$

$$a_{r \text{ tot}} \Leftarrow \omega^2 \cos^2 \alpha \left( R - \frac{G m}{5 c^2} \right) - \frac{G m}{R^2} \quad (9.2)$$

When looking at the tangential component, mainly the centrifugal but also the gyrotation forces push the surface mass to the equator, ( $a_{t \text{ tot}}$  is maximal for  $\alpha = 45^\circ$ ) but considering the radial component, the closer to the equator the more the gyrotation forces push the mass inwards the centre of the sun.

The sun's plasma will begin to rotate internally by creating two toroid-like motions, one in the northern hemisphere, one in the southern.

The differential spin of the sun is not explained by this. For some reason, the spin velocity at the equator is faster than near the poles.

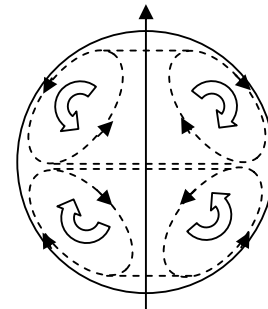


fig. 9.1.

## 10. Binary stars with accretion disc.

### *Fast rotating star analysis : creation of bursts, turbulent accretion disks.*

In section 7 we have seen that rotary stars have the tendency to evolve towards a toroid-shaped star. Let's take such a star with an accretion disk.

Near the rotary star we have the following. The accretion ring is prograde at the start of its formation. But the prograde motion results into a radial attraction of the ring towards the rotary star following

$$\mathbf{a}_r \Leftarrow \mathbf{v}_{pr} \times \boldsymbol{\Omega} \quad (\text{fig. 10.2, particles A, B, C}).$$

When the matter of the accretion ring (particles A and C) approach the radial

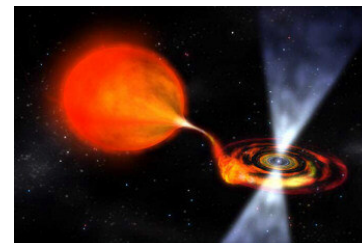


fig. 10.1

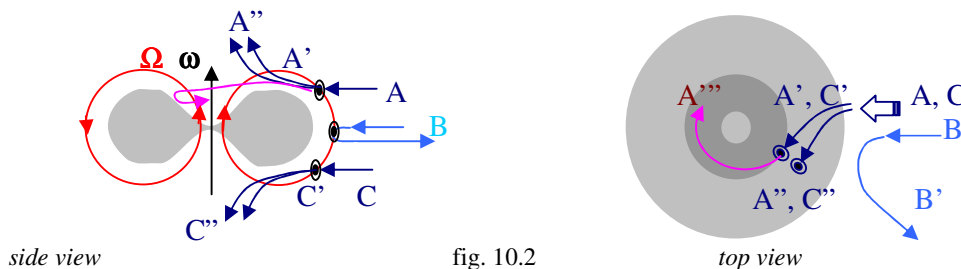


fig. 10.2

way with velocity  $\mathbf{v}_A$ , it gets a strong acceleration  $\mathbf{a}_R$  which is retrograde, (particles A' and C') according to :  $\mathbf{a}_R \Leftarrow \mathbf{v}_A \times \boldsymbol{\Omega}$  (fig. 10.2 top view).

With fast rotating heavy masses this acceleration is enormous. Then, when the particles move by retrograde way (for each velocity  $\mathbf{v}_R$ ), again an acceleration  $\mathbf{a}_P$  is exerted on the particles in another perpendicular direction (particles A'', C'') according to :  $\mathbf{a}_P \Leftarrow \mathbf{v}_R \times \boldsymbol{\Omega}$ .

As a consequence these particles are projected away from the poles.

At the equator level, the mass is sent back towards the accretion disc (particles B, B'), after a short retrograde motion. Consequently, we expect an accretion ring whose closest fraction to the rotary star is almost standing still, with local prograde vortices.

If a particle, due to collisions, gets inside the toroid to the level of the equator, it can be trapped by the gyrotation in a retrograde orbit (particle A'''), or if prograde, absorbed.

This effect can result in a temporary crowding, after which the accumulation should disappear again due to the limited space and because of the local gyrotation forces.

The observed spin-up and spin-down effects are possibly explained by these trapped particles.

When these phenomena are observed, high energy X-rays are related to it. It seems not likely that these X-rays would be gravitational waves. But there is another possible origin for these X-rays. One should not forget that the velocity of the bursts is extremely high, and probably faster than light for some particles. Both the relativity theory and the aether theories would say that high energies are involved. Considering that matter is “trapped light”, and for aether theories, that the particles are forced through a slow ether, the stability of these particles could be harmed seriously. If so, the light can escape from the trap, and scatter as X-rays.

**Bursts of collapsing stars.**

When a rotating star collapses, this happens in a very short time, and it will result in a burst. What is its process ?

The conservation of momentum causes a quick increase of its spin when a collapse occurs. And an increase of spin velocity results in an fast increase of gyrotation forces :

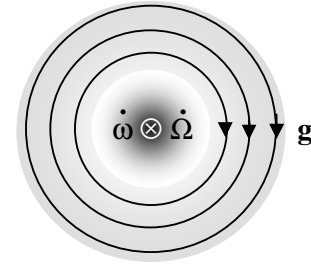


Fig. 10.3

The law (1.5) :  $\nabla \times \mathbf{g} \Leftarrow - \partial \mathbf{\Omega} / \partial t$

is responsible for a huge circular gravitation force in the accretion ring. The attraction occurs in a circular way instead of a radial one.

The consequence is a strong contraction of the accretion ring, resulting in sudden shrinking, and so a precipitated repulsion of accretion matter, away from the star at the equator and at the poles, as described in the former section.

A burst will occur both at the poles and at the level of the accretion ring (see fig. 10.4 and fig. 10.5).

**Calculation method for the accretion disc of a binary pulsar.**

Studies about accretion disks are mostly accomplished by thermodynamics. However, the gyrogravitational aspects are interesting as well. Consider fig. 10.4 in order to analyse the absorption process. Matter is absorbed

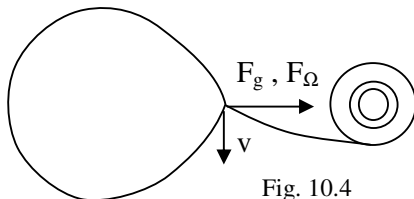


Fig. 10.4

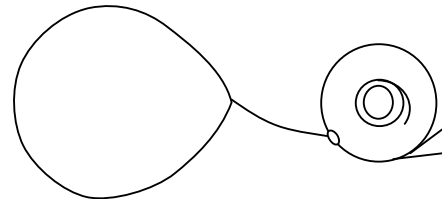


Fig. 10.5

according to equation (10.1), and will be attracted by gravitation and gyrotation forces near the rotary star. This matter goes prograde, and some of it will flow over the poles, which is then ejected as beams. Some prograde matter at the equator level can be absorbed by the rotary star. But some matter can stay near the rotary star in the shape of a cloud, which is subject to the gyrotation pressure forces. A disc around the rotary star is being created according to this gyrotation pressure. The density of the ring will increase, and will approach the rotary star. But because of the limited thickness of the ring and it’s increasing pressure, it will also spill toward the outside. The masses that are pulled from the companion will then knock the widened ring (fig. 10.5).

The equilibrium equations can be produced again, this time for a ring of gasses. However, the velocity vector of the inner part of the disc near the rotary star determines whether the disc material will be absorbed or ejected. Prograde matter can be attracted, but retrograde and in-falling matter is repulsed.

**11. Repulsion by moving masses.**

The authenticity of repulsion of masses is already deduced from drawing 10.2 (particle B), but this property of gyrogravitation can also be found directly from the theory, using (3.1): when two flows of masses  $\dot{m}/dt$  move in

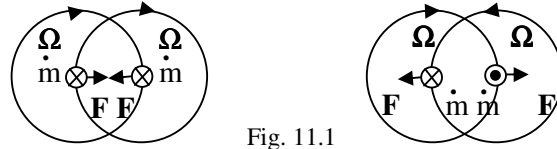


Fig. 11.1

the same way in the same direction, the respective fields attract each other. For flows of masses having an opposite velocity, their respective gyrotation fields will be repulsive. It is clear that the velocity of the two mass flows should be seen in relation to another mass, in (local) rest, and large enough to get gyrotation energy created, as explained in section 3.

Spinning masses do the same. Two fast rotation masses with the same spin will get an apparently lower mass, because the gyrotation forces are repulsive. Masses with opposed spins will appear heavier.

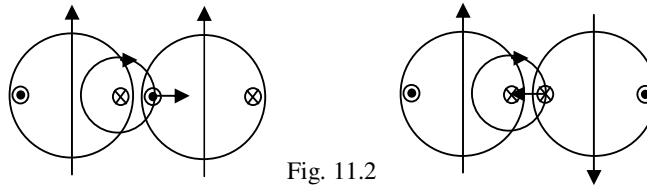


Fig. 11.2

In these cases, the spinning masses themselves create the reference gravitation field needed to get the gyrotation effects produced.

## 12. Chaos explained by gyrotation.

The theory can explain what happens when two planets cross each other. Gravitation and gyrotation give an noticeable effect of a chaotic interference. Let's assume that the orbit's radius of the small planet is larger than the one of the large planet. When passing by, a short but considerable attraction moves the small planet into a smaller orbit.

At the same time, gyrotation works via  $\mathbf{a}_O \Leftarrow \mathbf{v}_R \times \boldsymbol{\Omega}$  on the planet in the following way (fig. 12.1): the sun's and the large planet's gyrotation act on this radial velocity of the planet by slowing down it's orbital velocity. The result is a slower orbital velocity in a smaller orbit, which is in disagreement with the natural law of gravitation fashioned orbits (simplified form):

$$v = (GM/r)^{-1/2} \tag{12.1}$$

Thus, in order to solve the conflict, nature sends the small planet away to a larger orbit. Again, gyrotation works on the radial velocity, this time by increasing the orbital velocity, which contradicts again (12.1). We come so to an oscillation, which can persist if the following passages of the large planet come in phase with the oscillation.

One could say that only gravitation could already explain chaotic orbits too. No, it is not: if no gyrotation would exist, the law (12.1) would send the planet back in it's original orbit with a fast decreasing oscillation. Gyrotation reinforces and maintains the oscillation much more efficiently, and allows even screwing oscillations.

## 13. The link between Relativity Theory and Gyrotation Theory.

The analysis of relative motion is one of the most critical elements in the Maxwell Analogy. Einstein denied the problem by defining that we should be able to describe every relative motion independently from the chosen observer. In this chapter, we will apply this interesting concept.

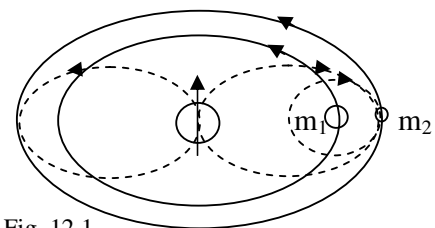


Fig. 12.1  
The orbits are represented as plain ellipses; dotted lines are representing gyrotation equipotentials.

Let us take two flows of moving masses  $\dot{m}$ . When they move in the same direction, attract. Whether one observer follows the movement or not, the effect must remain the same when we apply the relativity principle.

The two points of view are compared hereunder.

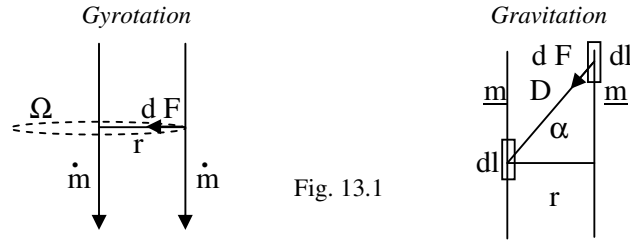


Fig. 13.1

The following notations are used:

$$\dot{m} = dm/dt \quad \text{and} \quad \underline{m} = dm/dl$$

For the gyrotation part, the work can be found from the basic formulas in sections 1 until 3 :

$$\underline{F} \Leftarrow \Omega \dot{m} \quad \text{and} \quad 2\pi r \cdot \Omega \Leftarrow \tau \dot{m}$$

where  $\underline{F} = dF/dl$  and  $\tau = 4\pi G/c^2$ .

So, 
$$\underline{F} = 2 G \dot{m}^2 / (rc^2) . \quad \text{Now} \quad \dot{m} = \underline{m} v$$

Hence, the work is :

$$\underline{F} dr = 2 G \underline{m}^2 v^2 / (rc^2) dr \quad (13.1)$$

For the gravitation part, the gravitation of  $\underline{m}$  acting on  $dl$  is integrated, which gives :

$$\underline{F} = 2 G \underline{m}^2 / r$$

The work is :

$$\underline{F} \cdot dr = 2 G \underline{m}^2 / r dr \quad (13.2)$$

Let's assume two observers look at the system in movement: an observer at (local) rest and one in movement with velocity  $v$ .

An observer at rest will say: the system in movement will exercise a work equal to the gravitation of the system at rest, increased by the work exerted by the gyrotation of the system in motion.

A moving observer will say: the system will exert a work equal to the gravitation (of the moving system).

Because of the principle of relativity, the two observers are right. One can write therefore:

$$\frac{2G(\underline{m}_{st})_{st}}{r} + \frac{2G(\underline{m}_v)_{st} v^2}{r c^2} = \frac{2G(\underline{m}_{st})_v}{r} + 0 \quad (13.3)$$

where " $(\underline{m}_v)_{st}$ " e.g. represents the moving mass, seen by the steady observer.

We can assume (due to the relativity principle) that:

$$(\underline{m}_{st})_v = (\underline{m}_v)_{st} . \quad \text{Hence, } (\underline{m}_{st})_{st} = (\underline{m}_v)_{st} \sqrt{(1-v^2/c^2)}$$

An important consequence of this is: the "relativistic effect" of gravitation is expressed by gyrotation. This could be expected from the analogy with the electromagnetism.

In other words: when the gravitation and the gyrotation are taken into account, the frame can be chosen freely, while guaranteeing a "relativistic" result.

The fact that the neutron stars don't explode can find its explanation through the forces of gyrotation, but can also be seen as a "mass increase" due to the relativistic effect. The mass increase of the relativity theory is however an *equivalent pseudo mass* due to the gyrotation forces which act locally on every point.

## 14. Discussion : implications of the relationship between Relativity and Gyrotation.

The discussion about the paragraph 13 relates to the consequences for the relativity theory. This paragraph is treated separately in "*Relativity theory analysed*", in order to not harm the objective of this paper which is to show how the gyrotation works and what it offers for the study of the dynamics of objects.

*Relativity theory analysed*

## 15. Conclusions.

Gyrotation, defined as the transmitted angular movement by gravitation fields in motion, is a plausible solution for a whole set of unexplained problems of the universe. It forms a whole with gravitation, in the shape of a vector field wave theory, that becomes extremely simple by its close similarity to the electromagnetism. And in this gyrotation, the time retardation of light is locked in.

An advantage of the theory is also that it is Euclidian, and that predictions are deductible of laws analogous to those of Maxwell.

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